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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/891,054	06/25/2001	Emiko Nishida	KPO108	9695

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EXAMINER	
MARKHAM, WESLEY D	

ART UNIT	PAPER NUMBER
1762	

DATE MAILED: 01/02/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/891,054	NISHIDA ET AL.	
	Examiner	Art Unit	
	Wesley D Markham	1762	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *14 October 2003*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-3* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-3* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☒ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *25 June 2001* is/are: a)☐ accepted or b)☒ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. §§ 119 and 120

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

13)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application) since a specific reference was included in the first sentence of the specification or in an Application Data Sheet. 37 CFR 1.78.

a) ☐ The translation of the foreign language provisional application has been received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121 since a specific reference was included in the first sentence of the specification or in an Application Data Sheet. 37 CFR 1.78.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) *1 total* .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: .

DETAILED ACTION

Election/Restrictions

1. Applicant's election without traverse of Group I, Claims 1 – 3, drawn to a film forming method, in the response filed on 10/14/2003 (with a certificate of mailing dated 10/8/2003) is acknowledged. Additionally, the applicant's cancellation of non-elected Claims 4 and 5 is also acknowledged. Claims 1 – 3 are currently pending in U.S. Application Serial No. 09/891,054, and an Office Action on the merits follows.

Priority

2. Receipt is acknowledged of papers submitted under 35 U.S.C. 119(a)-(d) (i.e., the certified copy of foreign priority document JP 2000-200913), which papers have been placed of record in the file.

Information Disclosure Statement

3. The IDS submitted by the applicant on 12/2/2002 is acknowledged, and the references listed thereon have been considered by the examiner as indicated on the attached copy of the PTO-1449 form.

Drawings

4. The formal drawings (17 sheets, 19 figures) filed by the applicant on 6/25/2001 have been received.

5. The drawings are objected to as failing to comply with 37 CFR 1.84(p)(5) because they include the following reference sign(s) not mentioned in the description: "l", "n_L", "d_L", "n_1", and "n_2" in Figure 6, and "14M" in Figures 15 and 16B. A proposed drawing correction, corrected drawings, or amendment to the specification to add the reference sign(s) in the description, are required in reply to the Office Action to avoid abandonment of the application. The objection to the drawings will not be held in abeyance.

Specification

6. Applicant is reminded of the proper language and format for an abstract of the disclosure. The abstract should be in narrative form and generally limited to a single paragraph on a separate sheet within the range of 50 to 150 words. It is important that the abstract not exceed 150 words in length since the space provided for the abstract on the computer tape used by the printer is limited. The form and legal phraseology often used in patent claims, such as "means" and "said," should be avoided. The abstract should describe the disclosure sufficiently to assist readers in deciding whether there is a need for consulting the full patent text for details. The language should be clear and concise and should not repeat information given in the title. It should avoid using phrases which can be implied, such as, "The disclosure concerns," "The disclosure defined by this invention," "The disclosure describes," etc.

7. The disclosure is objected to because of the following informalities:

- Page 5, line 6: The phrase, "This optimization count be achieved using a commercially available design software..." appears to contain a typographical error. Specifically, it appears as though the word "count" should be either "can" or "could".
- Page 11, line 20: The phrase, "Optimize thickness each layer so that..." appears to contain a typographical error (i.e., the word "of" appears to be missing from between the words "thickness" and "each").
- Page 11, lines 22 – 24: The phrase, "determine the wavelength of monitor light so that the transmittance of the interim multilayer film with that layer as the outermost layer, and store the thus determined wavelength in a memory" is unclear and confusing. Specifically, it is unclear what the phrase, "so that the transmittance of the interim multilayer film with that layer as the outermost layer" means or refers to.
- Page 12, lines 26 and 27: The phrase "memory 14" appears to contain a typographical error. It appears as though the aforementioned phrase should read "memory 14M" in order to correspond to Figures 15 and 16B.

Appropriate correction is required.

Claim Objections

8. Claim 2 is objected to because of the following informalities: The phrase, "wherein said step 8a) includes..." appears to contain a typographical error. Specifically, "8a)" should read "(a)". Additionally, the phrase, "letting two wavelengths in the variable

wavelength range of said variable wavelength light source being represented by λ_1 and λ_2, optimizing said each layer within the range of $\lambda_1/4$ to $\lambda_2/4$" appears to contain typographical / grammatical errors. It appears that the aforementioned phrase should read, "letting two wavelengths in the variable wavelength range of said variable wavelength light source be represented by λ_1 and λ_2, and optimizing said each layer within the range of $\lambda_1/4$ to $\lambda_2/4$". Appropriate correction is required.

Claim Rejections - 35 USC § 112

9. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

10. Claims 1 – 3 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

11. Regarding independent Claim 1 (from which Claims 2 and 3 depend), the phrase, "is determined by its optimization in the neighborhood of $\lambda/4$" is unclear and renders the scope of Claims 1 – 3 vague and indefinite. Specifically, it is unclear what optical thickness values are encompassed by the limitation "in the neighborhood of $\lambda/4$" (i.e., how close does an optical thickness value have to be to $\lambda/4$ to be considered to be "in the neighborhood of $\lambda/4$"?). In other words, the term "in the neighborhood" in Claim 1 is a relative term that renders the claims indefinite. The term "in the neighborhood" is not defined by the claim, the specification does not provide a

standard for ascertaining the requisite degree, and one of ordinary skill in the art would not be reasonably apprised of the scope of the claimed invention.

12. Regarding Claim 2, the phrase, "optimizing said each layer within the range of $\lambda_1/4$ to $\lambda_2/4$" is confusing and renders the scope of Claim 2 unclear. Specifically, it is unclear what characteristic of each layer is "optimized" within the range of $\lambda_1/4$ to $\lambda_2/4$ (i.e., is it each layer itself that is "optimized", or is it the optical thickness of each layer that is "optimized"?)

13. Regarding Claim 3, the limitation, "said step (a) includes a step of storing a waveform determined for said each layer in a memory and said step (b) includes a step of reading out of said memory the wavelength corresponding to said each layer" is confusing and renders the scope of Claim 3 unclear. Specifically, it is unclear whether the "waveform determined for said each layer" and the "wavelength corresponding to said each layer" recited in the aforementioned limitation are the same or not. In other words, is the "waveform" stored in the memory the same as the "wavelength" read out of the memory? If not, what is the difference between the "waveform" and the "wavelength" recited in Claim 3? For the purposes of examination only, the examiner has interpreted the "waveform" and the "wavelength" recited in Claim 3 to be equivalent.

Claim Rejections - 35 USC § 103

14. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

15. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

16. Claims 1 and 2 are rejected under 35 U.S.C. 103(a) as being unpatentable over Cushing (USPN 6,011,652) in view of Besset et al. ("Synthesis and research of the optimum conditions for the optical monitoring of non-quarter-wave multilayers", Applied Optics, 1993) and Uetsuki et al. (USPN 3,892,490).

17. Regarding independent **Claim 1**, Cushing teaches a method for producing / designing an optical multilayer filter having a predetermined number of layers in which the optical thickness of each of said layers of a $\lambda/4$-oriente structure is determined by its optimization to a value of either $\lambda/4$ or a value around $\lambda/4$ (Abstract, Col.1, lines 5 – 10 and 58 – 67, Col.2, lines 1 – 31, Col.3, lines 1 – 60, Col.4, lines 16 – 22 and 56 – 67, Examples 1 – 4, and Tables 1 – 4). Specifically, Cushing teaches that the multilayer filter is made up of many alternating layers of

high-refractive index (e.g., titanium oxide, tantalum pentoxide, etc.) and low-refractive index (e.g., silicon oxide, silicon dioxide, etc.) materials (Col.3, lines 38 – 49, Examples 1 – 4, and Tables 1 – 4), and the optical thickness of each of the layers is designed and optimized to be $\lambda/4$ for some layers and non-$\lambda/4$ for other layers so that ripple is reduced in a secondary passband of the multilayer optical bandpass filter (Col.1, lines 5 – 10, Col.2, lines 3 – 31, Col.4, lines 16 – 22 and 56 – 67, and Tables 1 – 4). Cushing does not explicitly teach how the multiple layers, each having the optimized optical thickness that may or may not be $\lambda/4$, are formed on the substrate. In other words, Cushing does not explicitly teach the steps of (1) determining the wavelength of monitor light for each layer of optimized thickness so that the transmittance or reflectivity of an interim multilayer film with each layer formed as the outermost layer reaches an extreme value, (2) setting the wavelength of monitor light to be emitted from a variable wavelength light source to the determined wavelength at the time of forming each layer, detecting transmitted light through or reflected light by the interim multilayer irradiated with the monitor light, and deciding whether the detected output has reached an extreme value, (3) stopping the formation of each layer when it is decided that the extreme value has been reached, and (4) repeatedly performing the aforementioned steps to form the predetermined number of layers. Specifically, Cushing is silent regarding how the alternating high- and low-refractive index layers are deposited to have the optimized optical thickness values. Besset et al. teaches that, in the art of making multilayer optical filters comprising alternating layers of high- and low-refractive index materials

such as TiO_2 or Ta_2O_5 and SiO_2, respectively, in which some of the layers are non-quarterwave (i.e., filters such as those taught by Cushing), the desired thickness of each layer can be obtained by (1) determining the wavelength of monitor light for each layer of optimized thickness so that the transmittance or reflectivity of each subsequently deposited layer reaches an extreme value (i.e., a max or min), (2) monitoring the transmittance for the chosen wavelength, and (3) stopping the deposition of each layer when the correct thickness is reached (Abstract, pages 5612 – 5615 and 5618, and Table 1). Uetsuki et al. teaches an optical monitoring system and process that is specifically designed to successfully control the deposition of multiple layers on a substrate so that some of the layers have an optimized non-quarterwave thickness (Col.5, lines 61 – 67, and Col.2, lines 1 – 32 and 60 – 64). The deposition / monitoring process of Uetsuki et al. comprises the steps of (1) determining the wavelength of monitor light for each layer of optimized thickness so that the transmittance or reflectivity of an interim multilayer film with each layer formed as the outermost layer reaches an extreme value, (2) setting the wavelength of monitor light to be emitted from a variable wavelength light source to the determined wavelength at the time of forming each layer, detecting transmitted light through or reflected light by the interim multilayer irradiated with the monitor light, and deciding whether the detected output has reached an extreme value, (3) stopping the formation of each layer when it is decided that the extreme value has been reached, and (4) repeatedly performing the aforementioned steps to form the predetermined number of layers (Abstract, Figures 1, 2, and 4, Col.1, lines 6 – 10,

Col.3, lines 9 – 24, Col.5, lines 61 – 67, Col.6, lines 1 – 32, and 55 – 64, Col.7, lines 3 – 60, Col.9, lines 19 – 55, and Col.17, lines 24 – 46). Uetsuki et al. teaches that the aforementioned monitoring / deposition process permits optical thickness compensation to meet the design parameters and provides the optical designer with a significant advancement in the art (Col.6, lines 60 – 64). Therefore, it would have been obvious to one of ordinary skill in the art to utilize the optical monitoring / deposition process taught by Uetsuki et al. to produce the optical multilayer filter of Cushing with the reasonable expectation of (1) success, as Besset et al. teaches that a such a variable wavelength monitoring system can be utilized to control the deposition of alternating high- and low-refractive index layers in a multilayer filter deposition process, and (2) obtaining the benefits of using the monitoring / deposition process taught by Uetsuki et al., such as the ability to deposit both quarterwave and non-quarterwave layers and form a multilayer coating in which each layer has an optimized optical thickness, as desired by Cushing. In other words, since the combination of Uetsuki et al. and Besset et el. teaches an optical monitoring system / method that is specifically designed to deposit multilayer optical films in which some layers are quarterwave and others are non-quarterwave, it would have been obvious to use such a method to deposit the optimized multilayer films of Cushing (i.e., multilayer filters in which some layers are quarterwave and others are non-quarterwave). Regarding **Claim 2**, the combination of Cushing, Besset et al., and Uetsuki et al. also teaches that the step of determining the wavelength of monitor light includes optimizing the optical thickness of each layer

within the range of $\lambda_1/4$ to $\lambda_2/4$, wherein λ_1 and λ_2 represent two wavelengths in the variable wavelength range of the light source (Col.7, lines 3 – 60, Figure 4, and Table 2 of Uetsuki et al.).

18. Claim 3 is rejected under 35 U.S.C. 103(a) as being unpatentable over Cushing (USPN 6,011,652) in view of Besset et al. ("Synthesis and research of the optimum conditions for the optical monitoring of non-quarter-wave multilayers", Applied Optics, 1993) and Uetsuki et al. (USPN 3,892,490), and in further view of Southwell et al. (USPN 5,000,575).

19. The combination of Cushing, Besset et al., and Uetsuki et al. teaches all the limitations of **Claim 3** as set forth above in paragraph 17, except for a method that further comprises storing the determined monitor light wavelength for each layer in a memory and reading out of the memory the aforementioned wavelength corresponding to each layer. Specifically, while Uetsuki et al. does teach determining the desired monitor light wavelength for each layer and switching from one monitor light wavelength to a different monitor light wavelength as the deposition of one layer is finished and the deposition of the next layer is started (Figure 4 and Col.9, lines 19 – 55), Uetsuki et al. is silent regarding how the optical monitoring system performs the switching from one predetermined monitoring wavelength to a different predetermined monitoring wavelength at the end/beginning of the deposition of each layer. However, it is clear that the monitoring wavelength information for each layer must somehow be provided to the system – otherwise, the aforementioned

wavelength switching could not be performed. Southwell et al. teaches that it was known in the art of film thickness optical monitoring at the time of the applicant's invention to store desired, predetermined process information in the memory of a computer prior to beginning the deposition process and to use such information to control the deposition and monitoring apparatus (Col.4, lines 47 – 68, and Col.5, lines 1 – 2). Therefore, it would have been obvious to one of ordinary skill in the art to store the predetermined monitor light wavelength for each layer in a computer memory and to read out of the memory the aforementioned wavelength corresponding to each layer at the time that each layer is deposited in the process of the combination of Cushing, Besset et al., and Uetsuki et al., with the reasonable expectation of successfully and advantageously providing the monitoring wavelength information for each layer to the system so that the switching from one monitor light wavelength to a different monitor light wavelength between the deposition of successive layers could be performed and controlled automatically (i.e., by a computer).

Conclusion

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Southwell et al. (USPN 5,425,964), Bey et al. (USPN 3,744,916), and Holland (USPN 4,311,725) all teach various optical thickness monitoring / deposition control means based on transmittance and/or reflectance values of the deposited film. Miller (USPN 5,238,738) teaches a method of making a multilayer optical

filter having alternating layers of high- and low-refractive index materials deposited on a substrate, the method comprising stopping the deposition of each layer of the multilayer when the reflectance of the interim multilayer reaches either a minimum or maximum value corresponding to a quarterwave optical thickness of the layer.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Wesley D Markham whose telephone number is (571) 272-1422. The examiner can normally be reached on Monday - Friday, 8:00 AM to 4:30 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Shrive Beck can be reached on (571) 272-1415. The fax phone number for the organization where this application or proceeding is assigned is (703) 872-9306.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0661.

Wesley D Markham
Examiner
Art Unit 1762

WDM

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